

## Research Note

# Hematozoa in Autumnal Migrant Raptors from the Hawk Ridge Nature Reserve, Duluth, Minnesota

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**ABSTRACT:** Blood from 159 raptors of 9 species from the Hawk Ridge Nature Reserve, Duluth, Minnesota was examined for hematozoa. *Accipiter striatus*, *A. cooperii*, *A. gentilis*, *Circus cyaneus*, *Buteo jamaicensis*, *B. platypterus*, *Falco peregrinus*, *F. columbarius*, and *Asio otus* harbored both *Leucocytozoon toddi* and *Haemoproteus*. *F. columbarius* and *Asio otus* had only *Leucocytozoon toddi*, and one *F. peregrinus* was not infected. The prevalence of hematozoans was similar between age classes of the sharp-shinned hawk (*Accipiter striatus*) and goshawk (*Accipiter gentilis*), but in the Cooper's hawk (*Accipiter cooperii*) immatures were more frequently infected than adults. There were no significant intersexual differences in infection rates for accipiters.

**KEY WORDS:** Cooper's hawk, sharp-shinned hawk, northern harrier hawk, red-tailed hawk, broad-winged hawk, peregrine, merlin, goshawk, long-eared owl, *Leucocytozoon*, *Haemoproteus*, Lake Superior Flyway, fall migrants.

Only 2 studies, both from the eastern U.S.A., have been published on hematozoa of fall migrating raptors. Kirkpatrick and Lauer (1985) surveyed 11 species and found *Leucocytozoon toddi*, *Haemoproteus elani*, *H. tinnunculus*, *Plasmodium circumflexum*, and *Trypanosoma* sp. Powers et al. (1994) examined sharp-shinned hawks (*Accipiter striatus*) and compared packed cell volume, total solids, white blood cell counts, and prevalence of hemoparasites (*Haemoproteus* sp. and *Leucocytozoon toddi*). Here we provide baseline data from a central U.S. flyway regarding the prevalence of blood parasites in autumnal migrating raptors of known sex and age.

During 1992 and 1993, 159 fall migrating raptors of 9 species were trapped at the Hawk Ridge Nature Reserve, Duluth, Minnesota (49°N, 92°W) using mist nets and bow nets. For a description of the study area and trapping techniques, see Evans (1980) and Rosenfield and Evans (1980). Blood was taken with a syringe from the brachial vein. Thin smears were made on microscope slides, air-dried, fixed in methanol, and stained in Giemsa. Each slide was examined for at least 1 hr at 100, 200, 400, and 1,000 $\times$ . One positive

slide (37994–38003) from each species of bird was deposited in the University of Nebraska State Museum, Harold W. Manter Laboratory Collection, Lincoln, Nebraska 68588.

Statistical tests follow Zar (1984) and were conducted with StatXact-Turbo (Mehta and Patel, 1992). Significance was accepted at the 0.05 level.

Our data indicate that *Leucocytozoon toddi* and *Haemoproteus* sp. are relatively common in various species of fall migrating raptors at Duluth, Minnesota (Table 1). Our prevalence rates are generally similar to those reported for the same species by Kirkpatrick and Lauer (1985). However, they detected two parasites we did not: *Plasmodium* sp. and a microfilarial stage from red-tailed hawks.

Hematozoa were found in both sexes of immature and adult sharp-shinned and Cooper's hawks and both sexes of goshawks, but we did not detect *Haemoproteus* sp. in adult goshawks (Table 2). There was no statistical difference between the proportions of infected immatures and adults for sharp-shinned hawks or goshawks ( $P = 1.0$  and  $P = 0.22$ , respectively, Fisher's exact test). In the Cooper's hawk the proportion of infected immatures (100%) was significantly higher than the proportion of infected adults (69%) ( $P = 0.04$ , Fisher's exact test) (Table 3). There was no significant intersexual difference in infection rates for sharp-shinned hawks, Cooper's hawks, and goshawks ( $P = 1.0$ , 1.0, and 0.237, respectively, Fisher's exact test). In contrast to our findings for sharp-shinned hawks, and based on a smaller sample size than ours, Powers et al. (1994) found that immatures were more frequently infected than adults of that species among fall migrants in the eastern U.S.A. They did not detect *Haemoproteus* sp. in adult sharp-shinned hawks.

In an analysis of hematozoa from 30 avian families, Greiner et al. (1975) showed an inverse correlation between prevalence of parasites and

**Table 1. Prevalence of hematozoa in autumnal migrant raptors from the Hawk Ridge Nature Reserve in 1992 and 1993.**

| Species   | 1992 |         |         |         | 1993 |         |         |         |
|---|------|---------|---------|---------|------|---------|---------|---------|
|   | Ne*  | Np (%)  | NL (%)  | Nh (%)  | Ne   | Np (%)  | NL (%)  | Nh (%)  |
| Sharp-shinned hawk<br>( <i>Accipiter striatus</i> ) | 41   | 36 (88) | 33 (80) | 18 (44) | 14   | 10 (71) | 7 (50)  | 8 (57)  |
| Cooper's hawk<br>( <i>Accipiter cooperii</i> )      | 20   | 14 (70) | 15 (75) | 7 (35)  | 7    | 7 (100) | 6 (86)  | 5 (63)  |
| Northern goshawk<br>( <i>Accipiter gentilis</i> )   | 38   | 23 (61) | 21 (55) | 2 (0.5) | 10   | 8 (80)  | 3 (33)  | 2 (20)  |
| Northern harrier<br>( <i>Circus cyaneus</i> )       | 7    | 6 (86)  | 6 (86)  | 0 (0)   | 2    | 2 (100) | 1 (50)  | 2 (100) |
| Red-tailed hawk<br>( <i>Buteo jamaicensis</i> )     | 2    | 2 (100) | 2 (100) | 0 (0)   | 3    | 3 (100) | 3 (100) | 0 (0)   |
| Broad-winged hawk<br>( <i>Buteo platypterus</i> )   | 7    | 6 (86)  | 6 (86)  | 0 (0)   | 3    | 2 (67)  | 2 (67)  | 2 (67)  |
| Peregrine falcon<br>( <i>Falco peregrinus</i> )     |      |         |         |         | 1    | 0 (0)   | 0 (0)   | 0 (0)   |
| Merlin<br>( <i>Falco columbarius</i> )              | 1    | 0       | 0       | 0       | 1    | 1 (100) | 0 (0)   | 1 (100) |
| Long-eared owl<br>( <i>Asio otus</i> )              | 2    | 1 (50)  | 1 (50)  | 0 (0)   |      |         |         |         |
| Total   | 118  | 88 (75) | 84 (71) | 27 (23) | 41   | 33 (80) | 22 (54) | 20 (49) |

\* Ne = number examined, Np = number parasitized, NL = *Leucocytozoon*, Nh = *Haemoproteus*.

nest height on a local geographic basis—the higher the nest the fewer the parasites. That correlation did not appear to hold true for our study on nesting Cooper's hawks (Taft et al., 1994), nor does it appear to hold true for birds in this study, i.e., ground-nesting harriers *Circus cyaneus* have a high prevalence, but not significantly higher than other tree-nesting raptors.

Upon gross examination, none of the sampled birds in this study and that of Powers et al. (1994) exhibited signs of ill health when captured. It is thus difficult to speculate on the potential impact that these hematozoa may have on the sampled populations. According to Atkinson and Van Riper (1991), it is likely that hematozoa are pathogenic in their natural host, although little

**Table 2. Prevalence of hematozoa by sex and age for autumnal migrant accipiters at the Hawk Ridge Nature Reserve, 1992 and 1993.**

| Species            | Sex    | Age       | N  | Only<br><i>L. toddi</i><br>(%) | Only<br><i>Haemoproteus</i><br>(%) | <i>L. toddi</i> and<br><i>Haemoproteus</i><br>(%) |
|--------------------|--------|-----------|----|--------------------------------|------------------------------------|---|
| Sharp-shinned hawk | Male   | Immature  | 10 | 6/10 (60)                      | 1/10 (10)                          | 4/10 (40)   |
| Sharp-shinned hawk | Male   | > 1 year  | 8  | 2/8 (25)                       | 2/8 (25)                           | 1/8 (12.5)  |
| Sharp-shinned hawk | Male   | > 2 years | 1  | 0/1                            | 0/1                                | 0/1   |
| Sharp-shinned hawk | Female | Immature  | 21 | 6/21 (29)                      | 0                                  | 10/21 (48)  |
| Sharp-shinned hawk | Female | > 1 year  | 11 | 2/11 (18)                      | 3/11 (27)                          | 5/11 (45)   |
| Sharp-shinned hawk | Female | > 2 years | 4  | 0                              | 1/4 (25)                           | 0   |
| Cooper's hawk      | Male   | Immature  | 7  | 4/7 (57)                       | 0                                  | 3/7 (43)  |
| Cooper's hawk      | Male   | > 1 year  | 3  | 0                              | 0                                  | 1/3 (33)  |
| Cooper's hawk      | Male   | > 2 years | 1  | 0                              | 0                                  | 1/1 (100)   |
| Cooper's hawk      | Female | Immature  | 7  | 4/7 (57)                       | 0                                  | 2/7 (29)  |
| Cooper's hawk      | Female | > 1 year  | 4  | 0                              | 0                                  | 2/4 (50)  |
| Coopers' hawk      | Female | > 2 years | 5  | 4/5 (80)                       | 1/5 (20)                           | 0   |
| Goshawk            | Male   | Immature  | 18 | 11/18 (61)                     | 0                                  | 1/18 (0.55)                                       |
| Goshawk            | Male   | > 1 year  | 2  | 2/2 (100)                      | 0                                  | 0   |
| Goshawk            | Male   | > 2 years | 4  | 2/4 (50)                       | 0                                  | 0   |
| Goshawk            | Female | Immature  | 6  | 4/6 (66)                       | 0                                  | 2/6 (33)  |
| Goshawk            | Female | > 1 year  | 5  | 2/5 (40)                       | 0                                  | 0   |
| Goshawk            | Female | 2 years   | 13 | 5/13 (38)                      | 0                                  | 0   |

**Table 3.** The prevalence of hematozoans in age and sex classes of autumnal migrant accipiters at the Hawk Ridge Nature Reserve, 1992 and 1993.

| Species            | Age      | Infected (%) | Not infected (%) | Sex    | Infected (%) | Not infected (%) |
|--------------------|----------|--------------|------------------|--------|--------------|------------------|
| Sharp-shinned hawk | Immature | 20 (65)      | 11 (35)          | Male   | 15 (79)      | 4 (21)           |
|                    | Adult    | 16 (67)      | 8 (33)           | Female | 27 (75)      | 9 (25)           |
| Cooper's hawk      | Immature | 14 (100)     | 0                | Male   | 9 (82)       | 2 (18)           |
|                    | Adult    | 9 (69)       | 4 (31)           | Female | 14 (87.5)    | 2 (12.5)         |
| Northern goshawk   | Immature | 19 (76)      | 6 (24)           | Male   | 17 (71)      | 7 (29)           |
|                    | Adult    | 13 (57)      | 10 (43)          | Female | 12 (50)      | 12 (50)          |

is known about the physiological, behavioral, and ecological costs of such infections in wild bird populations. However, recent research suggests that parasites ranging from protozoans to arthropods do affect host populations, as in the western fence lizard (*Scleropus occidentalis*) infected with malaria (Schall, 1983), red grouse harboring *Trichostrongylus tenuis* (Dobson and Hudson, 1992), and the coral reef fish (*Chromis nitida*) parasitized by *Anilocra pomacentri* (Adlard and Lester, 1994). The physiology of migrating raptors is poorly documented and understood (Kerlinger, 1989), and this makes it more difficult to determine the effect of hematozoa on wild populations. Powers et al. (1994) were the first to correlate differences in hematological parameters between parasitized and nonparasitized sharp-shinned hawks. They found no physiological differences when comparing hematocrits and hemoglobins of infected vs. noninfected sharp-shinned hawks. Unfortunately, no such comparison is possible in our samples, as we did not gather hematocrit and hemoglobin information. More sophisticated blood tests and a better understanding of raptor physiology will be needed to determine the effect of hematozoa on these migrating birds.

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